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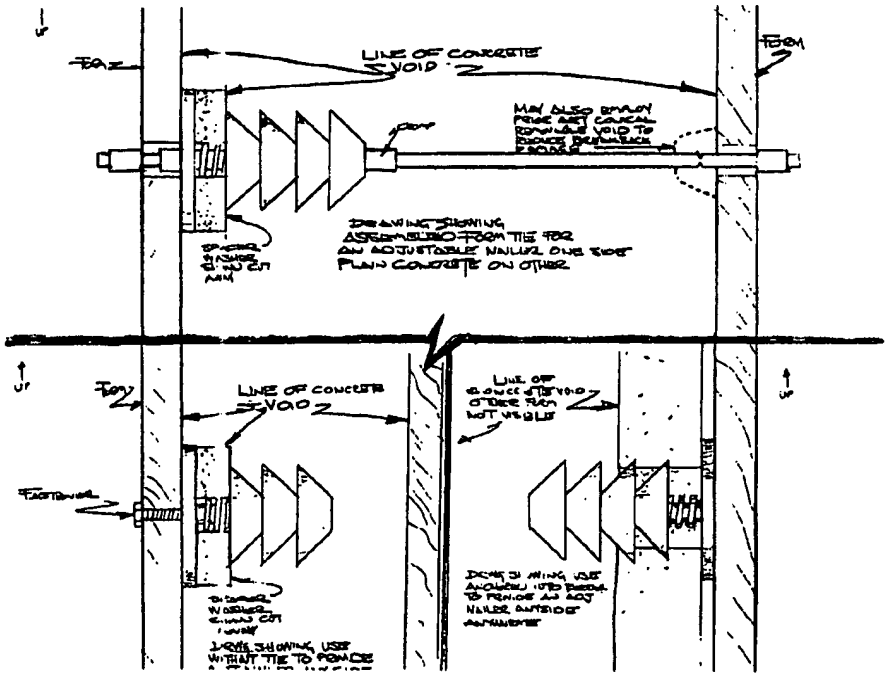
(54) Titre : DISPOSITIF ET METHODE DE FABRICATION DE PANNEAUX MOULES ET DE MONTAGE POST-FORME
(54) Title: APPARATUS AND METHOD FOR CAST PANEL FABRICATION AND POST-FORMED FIXTURING



(57) Abrégé/Abstract:
This invention relates to a component and method used in a casting process, most typically in the cold-process casting of concrete wall, floor, ceiling or other partition/bearing structural panels in situ in the construction of buildings, leaving embedded in the panel so cast a fastening surface which can (optionally) be adjustable to allow correction of non-uniform cast surfaces. The component may be part of the form-tie system which spans the distance between removable/reusable forms, holding them a set distance apart, and may as well hold a barrier material (typically expanded foam insulation sheet material) against the forms) while the casting process is underway, and when the forms are removed, leave an embedded portion which provides a material with a surface suitable for attaching other material such as wall-board or finishing sheet material or the like. The embedded portion may optionally be constructed so as to allow adjustment of the location of its mounting surface with respect to the cast surface and to other like components in the cast panel so as to provide for a (substantially) flat (or presumably other shaped) plane upon which finishing materials and/or fixtures may be mounted, as desired.

Draft Patent Disclosure

Title: Form-Tie Device Optionally Leaving Adjustable Fastening Surface Embedded in Cast Panel or Other End-Product

Inventor: JANEWAY, David, of Calgary, Alberta, Canada

References Cited (if any):

US5,861,105

1286517 _____

02225262, Martineau

(more...)

2. Field of the Invention

This invention is directed to improvements in the casting of concrete or similar materials into panels such as walls, ceilings, and floors in construction of buildings and the like using removable forms, whether of wood or formed by reinforcement applied to the outside of foam insulating panels where the foam panels are left in place after casting or otherwise by provision of a device which provides a number of advantageous features over the prior art. There is also some potential use of the invention to provide some of its post-installation benefits when used in stacking foam cast forms or when retro-fitted to existing cast surfaces.

3. Background of the Invention and Prior Art Disclosure

In this discussion, the invention as embodied in the apparatus disclosed here will be described as either the "component" or the "device".

Re-usable Form Systems, Generally:

To understand the invention, it is useful to describe a typical prior art plywood forming system as shown in FIGS. 1A, 1B and 1C. Such a system has conventional panels 10 of wood or metal. (Typically, they are plywood. Usually, the system also has specially sized and shaped panels such as corner pieces 10A and 10B and short straight pieces 10C.)

Each panel may have a series of parallel metal strengthening bands 1 running from edge to edge in a direction which is horizontal during the the use of the forms. The system as illustrated has four bands, but other systems may have other numbers of bands.

On bands 1 are hooking members 2. Most are shown hooked, but one, shown as 3 in FIG. 1A and shown in detail in FIG. 1B, is unhooked for illustration. Hooking member 3 is permanently attached to a band 1 on a panel 10 (in FIG. 1B, the panel 10 to the left of hooking member 3) by being pivotally secured for rotation about a large-headed pin 4. Hooking member 3 has a slot 5 which is sized to fit over the shaft of a large headed pin 6 on the band 1 of an adjacent panel 10. There are two smaller slots 7 in hooking member 3 which, when the hooking member is in closed position, lie over notches 8 in bands 1 and their associated panels 10.

FIG. 1C shows a cross-section through a form, showing two hooking members 2 in closed position and a tie 9. Tie 9 is secured in one of the notches 8 by having a narrowed portion 9A of its shaft pass through one of the slots 7 in each hooking member 2. It is retained in place because the narrowed portion 9A is just large enough to pass into slot 7. The normal cross-section of tie 9 (which can be of any suitable cross section, such as round, rectangular or square, see also Figures 1, 2, and 4) is too large to pass through slot 7. Thus, the tie is locked in position. The other end of tie 9 has a similar narrowed portion 9A, which locks it into position with respect to the form on the other side of the wall.

Form Tie Mechanisms:

Ties 9 are most usually made of metal, and remain in the wall after it is poured. They are provided with weakened portions 9B (the "breakback"), which can be severed using a suitable procedure after the plywood forms are removed, so that ties 9 will not then protrude from the concrete wall.

The ties may be made to conform to a variety of form panel-fastening devices, latches, and the like (see Figure 2 for some examples), and the panel latches are generally of the type shown in Figures 3 and 1B, and are designed to hold the form panels together, edge-to-edge while at the same time holding the form panels in specific alignment with the notches in the ties (Fig 1D, 9A) designed to mate with the panel-latches when closed, which by the whole system's design holds the form panels a fixed distance apart (neither spreading nor closing) before and during the pouring and casting process, to create the void within which the casting material is poured to form the (typically) cold-cast panel structure.

Fastening Surface Function:

As an additional method in the prior art, it is oftentimes done in construction to embed a wooden nailer or "ladder" into a cast concrete wall panel during fabrication (of a foundation, for example) by tacking a piece of wood to the inside of one side of the form system, and then pouring the concrete into the form to cast the wall panel. When the form is removed, there is left embedded in the cast panel the wooden nailer or "ladder" which provides a nailing surface upon which things may be mounted or attached, comprised of the wooden nailer or "ladder". This leaves the problem of weakened wall structures, concrete voids, loose nailers, uneven surfaces, the use of unsuitable and degradable materials, and unsightliness.

Form Spacing:

It is generally desirable when casting wall, ceiling or floor panels, that the forms be held a set and fixed distance apart, neither capable of coming together and thus forming a thin panel nor coming apart thus forming a thick and uneven panel and using too much material, both cases being uneconomical as well as structurally undesirable.

Incorporation of Barrier Material:

As well, when casting such panels where a barrier, of for instance thermally insulating foam sheeting, is to be formed as the outside of the cast panel (on one or both outside surfaces), it is necessary that the (foam) barrier be held tightly next to the form(s) prior to and during pouring and curing so that no voids are formed nor is the barrier allowed to intrude into the cast volume inside the forms, disrupting the continuity of the cast mass.

Tie Rod Function (Detailed):

Typical concrete form ties perform the function of holding a form in place relative to another form, or relative to some other anchorage. The void defined in part by the form is filed with concrete, the concrete sets, hardens and the forms may then be removed. The tie has held the form(s) to define the void within which the concrete is cold-cast to the desired shape, typically a wall or partition, foundation, floor, ceiling, or the like.

Variants on the Tie Breakback System:

Some commonly used tie systems incorporate a conical or other shaped disposable void-forming device deployed around the tie just at the inner surface of the form, to form a conical void in the concrete at the formed outer surface. This void form's function is, upon removal, to allow the tie (typically a pre-formed metal bar) to be bent back and forth until its end breaks off within the said formed conical void, so that the ties' ends are not protruding from the formed wall's surface, with no damage to the surrounding face of the wall. This breaking of the tie occurs at a pre-designed weakened point known as the tie "breakback". The conical void, after removal of the projection portion of the tie, is either patched if exposed to weather or humidity to prevent corrosion of the broken tie's metal exposed face, or left unfilled if this is no concern. The tie, having performed its purpose, becomes redundant, structurally, with the concrete mass of the formed panel.

Other common prior art tie systems use no conical or other shaped void form at the formed concrete surface. The "breakback" designed into the ties is reactive to torsional stress, and after the forms are removed, the tie-ends are twisted with the result that the tie breaks back within the interior mass of the cast panel, leaving no protruding

tie, but leaving a damaged portion of the panel surrounding the exit point of the tie prior to breakback. This damage is either patched or not, as desired, and the tie, again, becomes redundant with the mass of the formed panel.

Improvements Over the Prior Art with regard to Form Tie Functions:

The invention disclosed here has advantages over the prior art in that:

-the embedded tie component may be utilized as an anchorage for the embedded device, unlike the methods use prior;

-the break-back of the metal form tie occurs within the body of the component, resulting in no panel surface damage and no requirement to patch (the tie can be broken back either torsionally if so designed, at a predetermined weakened point within the body of the component, or by repeated bending by (temporary) removal of the inner part of the invented component to allow space within which the tie may be repeatedly bent to break and the subsequent replacement of the said inner part of the component)

-these improvements are in addition to the improvements disclosed here with regard to leaving a structural and optionally adjustable fastening surface or means for attachment of other things such as fixtures, handles, carriers, and the like, a means of positioning a foam or other barrier during (and after) casting of the panel or other feature, and as is otherwise disclosed herein.

-in one embodiment of the invention disclosed here, one or both ends of the form tie (which might be constructed of an metal or other coil whose adjacent wraps are affixed to each other forming a solid, threaded unit) could be threaded onto the device (by virtue of the device having been constructed with an internal threaded coupling to accept the tie's threaded end), leaving no protruding ends to be broken back. In another, the device or a portion of it can

be demounted from the tie, leaving a space within which the tie can be broken back conventionally, and the device (or demounted portion thereof) can be remounted.

Barrier Securing Function:

In the prior art may be found many different attempt to utilize stiffened foam panels as insulation after forming, and sometimes as well, as forms themselves during a casting process, with the aim of skipping an assembly/disassembly step during and/or after the casting process, to leave insulation affixed to the formed panel as a desired end-result.

For example, see US5,861,105, which discloses both in its description of the prior art and in its claimed invention, a method of using temporary stiffening bars attached to the form ties to provide a type of pre-formed foam panel with the stiffness and positioning to withstand the forces present in the pouring and casting of concrete panels in place.

As well, in another variant of the prior art, when conventional removable wooden forms are used, pre-formed foam panels are inserted within the void between two forms where concrete is later poured, placed closely adjacent to one of the forms, with the aim that the resulting wall will include a thermal barrier at that one surface, formed of the foam panel, as the outside of the said wall.

Thermal or other barriers or membranes have the effect of dividing the mass of the formed panel into distinct structural elements. This complicates the engineering and building code considerations due to the structure being considered composite rather than monolithic. In the field, it is difficult to suspend a barrier within a form without rupture

and movement due to head pressures developed by the uneven filling of the divided elements.

Also, this sort of technique is best suited to non-structural elements. This can be seen in the constructions of pre-cast or tilt-up type of wall panels where the casting takes place on a flat surface, and where thickness is controlled prior to the application of the barrier and (optionally) a subsequent layer of concrete. (Application of the system to this use will be discussed later in further detail under the anchoring function discussion.)

Thermal insulation or other barriers bonded to a cast concrete wall at the time of casting have been attempted for some time. This has not become widespread practice due to the difficulty of lacing two forms and up to two layers of insulation together with the tie acting to restrain all elements from moving relative to one another during the pouring and casting steps.

It is difficult and time consuming to line up the hole in the form, the (up to) two foam panels and then close up the forms aligning all the ties with all the holes in the "buttoning up" procedure. This was further aggravated by the lack of a standard grid matrix that ties an tie holes would be located relative to (and thus the lack of any standard to which foam panels could be produced to fit the grid array of form ties which, when assembled, would pierce the foam layer comprised of the foam panels).

It was also difficult to assure that the insulation panels had not moved out into the concrete void due to all the adjustments required.

In the current art, there are basically two techniques used to accomplish this sort of desired end result of casting in place a thermal barrier; the use of insulated concrete forms as taught in 1286517 _____.

Insulated Concrete Forms (ICF) are of two broad types: a pre-formed block type (fig __, ____) and a site-assembled panel, or board and tie system. Either type allows the construction of a poured concrete wall that is insulated on both sides when the concrete hardens. Both of these types of forming systems use expanded polystyrene or similar foam materials both as the contact surface as well as the backing material spanning between the support provided by flanges formed or attached to the metal or plastic or foam ties.

Nailing surfaces may be provided on some of these systems either on the surface as an extension to a web or tie, or embedded within the foam face shell (figure ___, B1, lower left).

The biggest application for these two systems is below grade single family residential walls, and our discussion will center around those uses.

These systems face the following problems in use:

-the concrete forms bursting strength is determined by the flexural and impact strength of the expanded polystyrene retrained by the crossties (fig___, ____).

-Consistent delivery of these required properties in face of the variables involved with the head and impact pressures of fresh concrete pours is difficult to achieve.

-Typically, the practice of vibrating walls with a mechanical immersion vibrator after pour but prior to curing is discouraged due to concerns over possible rupture due to damage caused by contact of the vibrator with the foam forms and also due to concerns for the increase in form pressure brought about by liquefying the concrete through vibration.

-Concerns for the complete compaction of the concrete are difficult to quantify or visually inspect, given that all exposed surfaces are covered with foam.

-Concerns for water-tightness due to lack of vibratory consolidation arise out of and can be attributed to lack of consolidation around the numerous ties required to reinforce the two (foam) face shells. Most ICF manufacturers now recommend changes to normal waterproofing procedures to overcome some of these concerns.

-These methods must be protected due to the strength of the foam substrate that they are bonded to, complicating the selection of material and the procedures used for back filling and soil compaction after forming.

-Human factors include the requirement for certified and or specially trained installers, and or an inspection prior to concrete pour.

-Installation can have a dramatic effect on both the bursting strength of the system, as well as the achieved physical properties of the wall (such as plumb, flatness, etc.) which are difficult to compensate for after the concrete sets and next to impossible to correct.

-Skilled labour attempts to address these concerns.

-Nailing surfaces are not adjustable to overcome these site deficiencies.

This system is additionally restricted in its use for a number of reason; it is practical only on exterior walls where thermal resistance is desired. The overall thickness of the wall is determined by the foam thickness required to contain the fluid concrete and not by the required thermal resistance. The thickness of the exterior shell adds to the overall dimension of the foundation which can effect building lot set backs as well as increasing the total building footprint. Building footprint is regulated in some jurisdictions. Thicker walls require changes to a number of building details such as width of window and door sills, etc. and adaptations from standard dimension lumber and finished parts, adding significantly to costs.

Code issues see a requirement for interior insulated surfaces to be covered with a fire rated material, such as drywall. In some jurisdictions, the use of a firewall is restricted due to the plastic ties connecting the two wall surfaces present in common commercially produced ICF systems. The use below grade in most termite areas is restricted or forbidden due to the foam providing a conduit for the insects to enter the home up the outside of the wall under the finishes.

The invention as disclosed here overcomes a great number of these drawbacks, some of the advantages of the invention over the prior art being as follows:

-Bursting strength is determined by the strength of a conventional concrete forming system, and not by the insulation

-the invention disclosed is less expensive, less technically stringent material can be used including recycled or part recycled plastic foams.

-Blow out concerns during forming is eliminated.

-The concrete can be conventionally vibrated with no concern to rupture.

-Concerns on water tightness are the same as for conventional forming.

-There are far fewer ties and subsequently far fewer places for voiding or bond failure to occur.

-use of a one-sided application allow conventional visual inspection for concrete compaction.

-Problems due to human factors are reduced by eliminating the need for special training.

-Properties such as plumb or flatness are routinely and effectively dealt with in the design and erection of the conventional concrete forming system, and deficiencies can be easily overcome with the adjustable feature of the invented component.

-Concrete can be insulated in a range of R-values on the inside and conventionally waterproofed and back filled on the outside.

-Building footprint is unchanged.

-Can be utilised in termite areas.

-Concrete can be insulated in a range of R-values on the outside and left plain on the inside, eliminating the need for a fire barrier on the inside.

-Exterior waterproofing issues the same as ICF with the elimination of waterproofing decisions based on the possibility of lack of concrete consolidation.

-Concrete can be insulated on the outside and have a finished wall on the inside with no furring or framing required.

-Minor formwork deficiencies are overcome with adjustable component feature.

-Concrete can be insulated on two sides in a range of R-values to suit specific needs.

-Allows conventional concrete vibration.

-Eliminates bursting strength concerns.

-Allows adjustment to overcome on site deficiencies after concrete hardens

Also in the prior art is disclosed a one-sided foam panel form option as shown in 02225262, Martineau.

This system uses the insulation as one side of the concrete form with the other side being a conventional concrete form. The system is not in widespread use and the restrictions and problems are not yet documented. Contrasting the design and concept of this system with the system we are disclosing, the following points are apparent:

-In general the system has many parts, and would appear to require a skilled and trained person to assemble. My invention has few parts and would require little or no training.

-The use of a foam panel functioning as the both the form and insulation requires a high-grade foam material with technical properties. My invention does not require high grade or virgin materials.

-The use of a foam panel functioning as a form requires the thickness of the material to be determined jointly by the required flexural strength of the panel, as well as the desired thermal resistance or R-value. My invention sees the thickness of the thermal insulation being determined by the required R-value desired.

-The Martineau foam panels require a tongue and groove edge preparation as well as a slot to be cut with precision. My invention requires a plain butted edge and a number of rough semi-circular

grooves so that panel preparation is minimal and could be easily accomplished on site with simple tools.

-A sort of nailer function is provided in Martineau, but requires an arm to pass through the concrete void and be anchored to the far side form with a pin. This restricts the location of the nailer to the edge of a formwork panel. As drawn in the upper portion of figure 3 the arm and embedment could not function as a tie as inward movement of the form would result in the assembly hinging in the middle.

-In Martineau, as contrasted with the other prior art and with my invention, the form tie runs along and is clipped to the tie, however no provision is given to being able to twist the tie to break it off without marring the nailer head or destroying the clip.

-The nailer provided in Martineau is not adjustable. The design requires proper orientation through a slot in the foam panel to hold the foam against the form. No provision is made to allow the embedment to adapt to other tie or forming systems.

-A nailer is not provided on the un-insulated wall.

-The nailer does not function as a tie but rather lies alongside the tie.

-The metal tie after the concrete sets is redundant after break back occurs.

-The Martineau invention claims use only for insulated wall construction and not for any other vertical, horizontal, or after forming use.

-Martineau's claim is for a forming system as a whole, while our application is for a component for use in both formed panels and otherwise at large.

Nailing Surface or Fixturing Function:

As noted above, early practices included affixing blocks of wood to the inside of a concrete form prior to pouring concrete. When the forms were removed after the casting process this block was used as a nailer to affix temporary or permanent components to the structure. The drawbacks to this system were the variability of the wood in terms of the ability to hold the nail, the effect of swelling and shrinking of the block within the hardened concrete pocket, rotting and insect attack in some geographic areas, and the inability to quantify the engineering properties of the connection.

Metal has also been used in this role and helped eliminate some of the variables as described. The drawbacks are that one cannot drive a nail into a metal plate and that most attachments were made by either welding or threading, neither of which is suitable for light cladding or finishing materials. Additionally, metals typically had to be plated or treated to reduce the potential for corrosion surrounding the embedment and the subsequent spalling of the concrete surrounding the embedment. Plating complicates the connection further due to the effect of destroying this treated surface while drilling or welding connections to it.

Aluminum was used for a brief while until it was discovered that a reaction between the concrete and aluminum would corrode and weaken the metal in contact with the mass. The use of aluminum in contact with concrete is now discouraged or forbidden in the trade.

These complications have resulted in the retrofitting (after pour and cure of the cast panel) of most light connections in the form of furring or strapping. These two practices affix a framework to the concrete and provide a nailing or screwing surface of wood or steel.

These elements are generally attached to the structure using a drilled and anchored connection, an explosive fastener, or an epoxied or glued joint. These are labour intensive manual procedures, especially when performed overhead. Epoxies and glues are also temperature and humidity dependent.

All of these procedures also add to the overall thickness of a wall, are subject in the case of steel to rusting, and to the case of wood to rotting, warping, or insect degradation.

Both furring and strapping can overcome some job site deficiencies such as a convex or concave surface, or out of plumb orientation (fig ___, ___). In the case of strapping this is done by shimming underneath the strapping to attain a flat, plain, attaching surface. This is a labour intensive procedure and requires skilled labour.

The end result is that cladding or finishing surfaces such as drywall can be applied to cast concrete surfaces. This is sometimes done directly by gluing the drywall directly to the wall. This procedure requires a dead flat, suitable concrete surface. The use of form oil or waxy substrate, the existence of form ridges or imperfections, or a dry carbonated surface, may result in adhesive failure. This method is limited due to these factors.

My invention overcomes many of these problems by providing an (optionally) adjustable, non-degrading nailing, screwing, or threading surface. This eliminates the need for furring, strapping, and shimming. This makes walls and columns take up less floor area, which is significant on high rise construction. The procedure is not weather dependent and does not require skilled labour, simply a straight edge and the tool to rotate or otherwise adjust the adjustable fixturing surface or flange. In addition, the

fixturing flange can be removed and replaced to increase the adjustment or to change the fixturing material, for example, a metal adjustable flange of similar shape could be installed to provide a welding surface. Other adaptations will be discussed under the anchorage function that follows.

The Anchoring Function:

As mentioned above anchorage is similar with the exception that all sorts of anchors can cast into concrete, whether these are rods, plates, chains, cables or the like. These are set in to the concrete prior to set and are non-adjustable after the concrete sets. All other construction procedures including concrete finishing and form stripping take place around these projecting objects.

My invention allows for an anchorage to be cast into and remain flush or slightly indented below the surface during the finishing, stripping and other construction procedures. This reduces job site hazards, reduces the potential damage to the projecting anchor and the concrete surrounding it, and most importantly allows the selection of a number of potential attachments to be made and amendments to the attachment to be determined and easily accomplished much further into the construction cycle.

Other existing methods of retrofitting anchorage include; drilling and inserting a deformable metal or plastic anchor, the use of an epoxy, expanding or non shrink cementitous grout, or molten metal embedding the object in a pre-formed or drilled hole, explosive fasteners, gluing or epoxying some device to the surface of the concrete.

These methods are again labour intensive, weather dependent, difficult or impossible to do overhead and require further shimming in some

circumstances to provide uniform bearing or bedding of the object being anchored to the structure. In most cases the anchors or fasteners must be surface treated to prevent corrosion.

My invention eliminates most of these objections by allowing an adjustable and convertible anchorage that is cast in and available undamaged at the point in the construction cycle where required. It also allows for temporary use and subsequent removal and simple patching rather than cutting, and leaves no corrodable surfaces to stain the surface or promote spalling where moisture is present.

Additionally, the component comprising my invention may if required by affixed as are the prior art anchors by drilling, gluing, otherwise embedding, and the like, but the component, being adjustable, requires less precise placement, less stringent methods, and less trained labour.

4. Draft Description

Summary and Objects of This Invention:

It is an object of this invention to provide an apparatus and method of use of same for the purposes of overcoming the foregoing problems found in the prior art, which:

4. embodied in the component or device, provides a stable nailing or fixturing surface within or on the surface of a cast panel such as a poured concrete ceiling, floor, or wall, which provides for an improved method of breakback of the form ties, and the fixturing surface of which is adjustable in relationship to other like devices so cast in the same surface, and to the cast surface itself, comprised of a stable, inert, non-metallic, plastic, metallic, weldable, glueable, screwable, material and surface as desired

5. provides a method when properly used of accomplishing one or all of the following:
    a. providing a means of breakback of conventional form ties without marring the formed surface,
    b. providing a means for securing a barrier material such as (but not limited to) a thermally insulating foam board to one or both sides of the cavity within a form system which is used to cast a panel such as a wall, floor or ceiling, simply and securely,
    c. providing a means of fixing material to the panel so formed, once formed, which provides for adjustment in relation to the panel's surface and to other similar devices embedded in a matrix in the casting process in the panel's face, and/or providing a means of affixing things to the panel via specialized surfaces, for example drywall or other decorative or functional (firewall and the like) panel treatements, or specialized adapters to accept, for example, threaded conduit or other hangers, and the like
    d. providing a means during the casting process of fixing conduit or reinforcing material a fixed distance from the outside surface of the eventually cast product, by acting, for example, as a bolster in the casting of a floor or tilt-up (horizontally cast) panel, while leaving a fixturing surface or device at the outside of the cast panel
    e. providing a means of retrofitting a cast or other surface with an adjustable fixturing surface of desired characteristics
    f. any more?

Description of This Invention:

The foregoing and similar objects may be achieved by an apparatus and method of constructing the same for [recite the claims here so they are embedded in the description to avoid under-disclosure problems later] as described in detail below.

Brief Description of the Drawings

[required]

Figures 1A through 1D are used to describe prior art form systems, and the interaction of ties, latches and form panels in use in one variant of the prior art

Figure 2 Shows a series of typical "form tie" ends designed for a variety of types of re-usable form panel systems for pouring concrete panels in situ.

Figure 3 shows an example of a "latch" typical of re-usable form systems

Figure 4 shows a breakaway drawing of a typical form system used to describe a typical prior art concrete panel re-usable form system in operation forming a wall panel segment with foam insulation on one side.

Figure 5 shows a partial cross-section of a form panel and tie in place during operation of a typical prior art system

Figure 6 shows a typical ICF Block pre-fabricated system of foam block concrete form systems typically used in lieu of a re-usable panel form system in the prior art

Figures 7-....requires revision

Detailed Description of One Embodiment of the Invention

(Recite Claims here in final version)

It is to be clearly understood that all the below-described types of arrangements, manufactures, and installations are to be construed as falling within the scope of the present invention, and are made as illustrations of the invention claimed.

The above description of the preferred embodiments of this invention is intended to be illustrative and not limiting. Other embodiments of this invention will be obvious to those skilled in the art in view of the above disclosure and the claims made below.

The device is comprised of a body in two parts, the embedded part being designed (shape and material) such that it will when embedded in a cast panel such as of poured concrete, be held within the cast panel and be difficult to remove. A simple drawing of such a shape is seen in (page 1, figure 1, item 1). The said embedded part 1 is internally threaded (or similarly adjustably engageable with the second part) axially through its centre and substantially perpendicularly to the outer surface of the panel within which it is to be embedded, to accept the second part 2 which is composed of the threaded or similarly adjustable engagement means with the said embedded part, and a larger face or surface, designed to be parallel with the outer surface of the panel within which the device as a whole will end up being installed. The said larger face or surface 3 has holes 4 or other suitable means of engaging a tool or finger with which the said second part can be turned or otherwise adjusted so that the outer plane of said larger face or surface 3 can be moved further or closer to the plane of the surface of the formed panel, while remaining substantially parallel thereto. If said adjustment means is a central threaded system as shown in the

drawings, said larger face or surface 3 should be substantially circular so that it can be easily turned within the space its body has formed during the forming process in the panel's creation. Depending upon the application (that is, where the thickness of the said second part of the device behind the said larger surface 3 at 5 is not sufficiently deep to allow the planned fastener such as a screw or nail to hold, that is where said fastener is longer than the depth of said thickness), it will be necessary to cast in place behind the said second part a washer of foam or other suitable material to hold the casting substance (such as concrete) out of the space adjacent to and behind the said larger face or surface 3 of the second part of the device 2 to allow a fastener to essentially pierce the thickness 5 of the second part of the device 2 and enter the space held by said washer 5 without damaging the fastener or the second part of the device.

When used in conjunction with a conventional re-useable form and tie panel casting system such as was described in the prior art section of this document (above), the device (figure page 9) 10 will be threaded (as a needle is threaded) onto the tie 11 which protrudes, typically from the assembled outside form 12 during the form and tie system's use, and placed adjacent to the inner surface of said outside form 12. Where a foam insulating barrier 13 is desired to result on the outer surface of the formed panel, said foam barrier is constructed with semi-circular indents 14 at pre-determined locations on the edge of its component panels to be fitted around the device 10 and to allow the device 10 which is frictionally or otherwise fixed to the tie 11, to hold the foam panel 13 frictionally by the fit of the semicircular indent 14 to the device 10 tightly adjacent to the said outside form's inner surface 12.

A second device 20 may be likewise threaded facing the other form 22 and frictionally or otherwise fixed to the said tie 11, which are then conventionally attached to the said inner form 22. If desired, a spacing washer 5 or a second insulating foam (or other) barrier may be placed around the second device 20.

As well, the device may be attached to either form at pre-determined or desired locations without having been threaded onto a form tie, to provide a specifically located fixturing surface embedded in a formed panel (fig. 2A, 2B, are examples) as shown in 5A and 5B, and alluded to in a tilt-up casting process in 3A and 3B.

A variety of implementations and uses of the device in the forming of panels is displayed in the drawings on pages 2A, 2B (showing use of spacer 2A and deployment with foam panel 2B), use as a bolster with a spacer to hold reinforcement bars in place during pouring and curing of a ceiling, wall, or tilt-up cast panel (where the pour and curing takes place on a horizontal orientation, with only one form-side (the bottom) required (aside from edge barriers during pouring in place) in 2C , 2D, 3A, 3B, and 3C; variants of the detailed description using the device in a conventional form and tie system with and without insulating foam barriers is shown in 4A, 4B, and 5C, and 11.

Drawing 11 at its RHSide shows the use of only the first part of the device and a foam or other washer to provide a breakback space and leave a threaded embedded part for attachment in future of a variety of second part devices such as are shown (hangers) in drawing 7A.

Drawing 12A and 7C show the use of the device in an ICF application, where the device is embedded into the side of the preformed foam block form to be cast into the end-result cast panel wall.

Drawing 12B shows the use of a threaded form tie as a variant of the first or embedded part of the device as described initially.

Alternatively, as shown in drawing 3D, the device can be retrofitted into existing panel or surface situations and bonded into place with glue, mortar or other suitable adhesive to provide for a desirably placed adjustable fixturing surface to the said panel.

One of the primary results of the invention's use will be the adjustable fixturing surface 3 which can be moved in relationship to others of its kind and to the surface within which the device is embedded, and to thus provide curative means for unevenly poured panel surfaces as in 8A, off-plumb (or off-level) panel surfaces as in 8B, or as a substitute for adhesives on a plumb and even panel surface as in 8C. Note that these situations are illustrative and not limiting, and that by their example, one skilled in the relevant art will immediately perceive a number of other situations where the invented device will prove useful.

JANEWAY, David
Draft Claims for Patent Application

I claim:

1. An apparatus for use in the casting of panels or other construction elements comprising:
   a. a body of suitable material and shape (generally flat outer face, generally thick enough or incorporating a backer to allow piercing by screw or nail or staple fasteners) to be cast into a panel or other construction element (such as a cold-cast formed poured concrete wall) and to accept fasteners as desired (such as nails, screws, adhesives)
   b. Said body being shaped in one or more sub-components which afford means of being adjustably and variably fixed and moved in a direction perpendicular to the surface of the thing within which it has been cast (or embedded)
      (i) where said body is shaped and is constructed of suitable materials, or suitable lubricants or other materials are coated thereon, such that when cast within a cast or formed material, the outer surface of the body causes the formed material to assume a shape which, in interaction with the body itself, provides a means of fixedly adjusting the depth of the body within the said formed material and thus the relationship of the body's outermost face to the surface of said formed material (such as where the body is formed on its outer surface of a bolt-thread, and the formed material once cast and hardened forms the mating female nut-thread, although there are other suitable variants such as frictional fits formed of adjacent ring-shaped outer protruberances along the shaft of the said body, which body may compress slightly to allow tightly fitted but moveably fitted engagement with matching ring-shaped detents within the female shaft shaped during casting by the shape of the said body) or
      (ii) where said body comprises two parts, an outer part which is cast within the formed material, and an inner part which carries the nailing or fixturing surface, and which is adjustable within the outer part in a direction defined (essentially) perpendicularly to the face of the formed surface within which the entire body and notably the outer part is cast or embedded (may be by threaded or friction or other suitable means) or
      (iii) where said body's second or inner part may be interchangeable with other components suitable for different purposes, such as hangers, bolsters, adhesive-receiving, nailers, screw receiving, or custom-made components
   c. Said body having a face on its outermost (in relation to the thing within which it is cast or embedded) end capable and suitable of receiving fasteners or adhesives and/or
   d. Said body being suitable to act as a détente to hold a barrier (such as thermal barrier of pre-expanded foam) next to the inner surface of a form used in the casting of panels or other construction elements and/or

e. Said body having a void within itself extending essentially linearly through its body about a central line perpendicular to the surface of the thing within which it is cast or embedded, suitable to surround a form tie of conventional design or is constructed such that it performs the same function as a conventioanl form tie when assembled from a number of attaching parts
   (i) said inner void being constructed or formed to include means to frictionally or otherwise be affixed to said conventional form tie and to thus form part of the temporary form structure, holding said body against the inner surface of the said form and assisting to hold said form to the proper distance along said form-tie such that the void formed by the said form and tie system is of desired configuration and/or
f. Said body being capable (in horizontal panel forming operations) of acting as a bolster or shim to hold reinforcing material (such as re-bar) and/or conduit (such as for electrical, communications, plumbing, control and/or other lines) fixed in a desired location within the volume to be formed by casting and/or
g. Said body being capable of acting as or of receiving further attachments to act as a means of lifting and/or manipulating the thing (such as a tilt-up cast panel) within which it is cast or embedded and/or
h. Said body being either cast within or embedded later within a panel or other cast or formed construction element and/or
i. Said body being capable of having affixed to it a hangar, rod, or other device from which ceilings, fixtures, or other finishing or construction elements may be hung and/or
j. Said body being capable of being inserted within a foam or masonry stack element prior to or during the assembly of that unit into a wall or other panel or construction element by masonry or casting or forming or combination methods, to provide the same utility as above-stated and/or

2. Variants such as "An apparatus as in Claim(s) 1 (-x) where said body's material is a thermoset plastic
3. An apparatus as in Claim(s) 1(- x) where said body's material is a shaped metal form
4. An apparatus as in Claim(s) 1(- x) where the outer part of said body is a shaped metal form and where the inner part of said body is of any of a number of suitable materials
5. An apparatus as in Claim(s) 1(- x) where ...

6. Other Variants as noted in the drawings or as would be apparent to one skilled in the relevant art

7. An apparatus for use after being embedded in cast panels or other construction elements comprising:

8. Variants as disclosed in the above claims, notably in the draft claim #1, and as would be apparent to one skilled in the relevant art from reviewing the disclosure in the draft specifications

9. A method of casting panels and other construction elements comprising the steps set out in the disclosure and specifications to which this is attached:

10. Variants of the methods for casting panels and other construction elements comprising the steps set out in the disclosure and specifications to which this is attached, or as would be apparent to one skilled in the art from reviewing the disclosure and specifications

11. A method of preparing a cast surface to accept a finishing treatment comprising the steps:

12. Where cast surface is of a wall

13. Where cast surface is of a ceiling

14. Where cast surface is of a floor

15. Variants of this functionality as would be apparent to one skilled in the art from review of the disclosure, claims and specifications attached

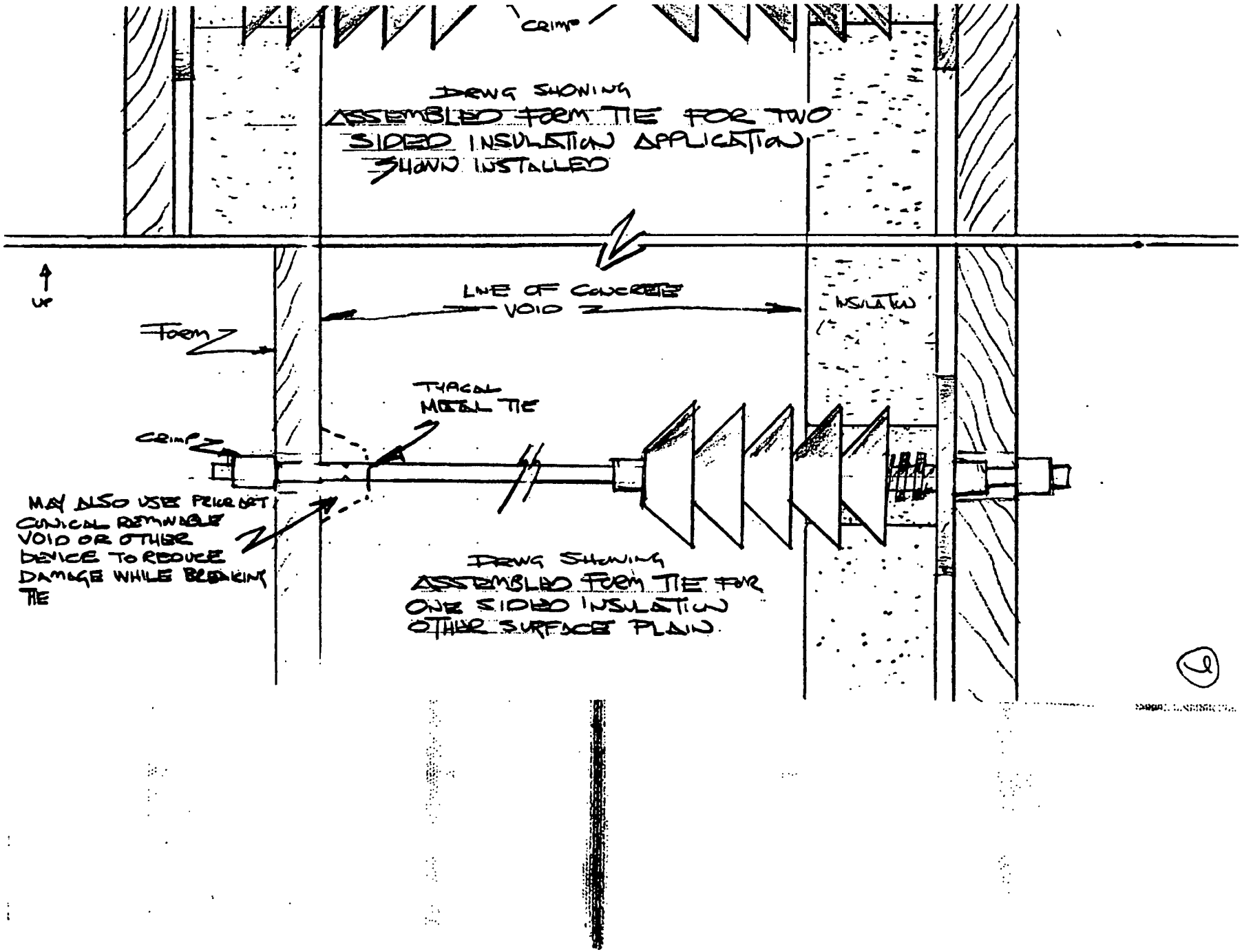
16. Methods of use of the apparatus in draft Claim 1, above, which are apparent from a review of the disclosure and specifications

17. Methods of use where the apparatus in Claim #1 is used in the finishing of cast panels, apparent from the disclosure, draft claims and specifications within.

1. Abstract

This invention relates to a component and method used in a casting process, most typically in the cold-process casting of concrete wall, floor, ceiling or other partition/bearing structural panels in situ in the construction of buildings, leaving embedded in the panel so cast a fastening surface which can (optionally) be adjustable to allow correction of non-uniform cast surfaces. The component may be part of the form-tie system which spans the distance between removable/reusable forms, holding them a set distance apart, and may as well hold a barrier material (typically expanded foam insulation sheet material) against the form(s) while the casting process is underway, and when the forms are removed, leave an embedded portion which provides a material with a surface suitable for attaching other material such as wall-board or finishing sheet material or the like. The embedded portion may optionally be constructed so as to allow adjustment of the location of its mounting surface with respect to the cast surface and to other like components in the cast panel so as to

provide for a (substantially) flat (or presumably other shaped) plane upon which finishing materials and/or fixtures may be mounted, as desired.



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PRIOR ART FIG. 5A

Fig. 1A

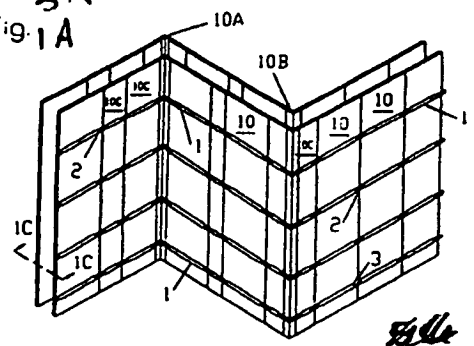


Fig. 1C

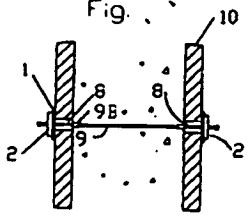


Fig. 1B

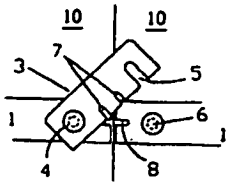


Fig. 1D

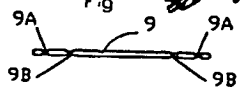
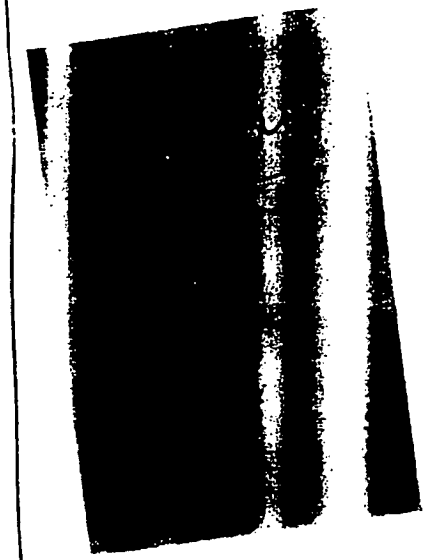
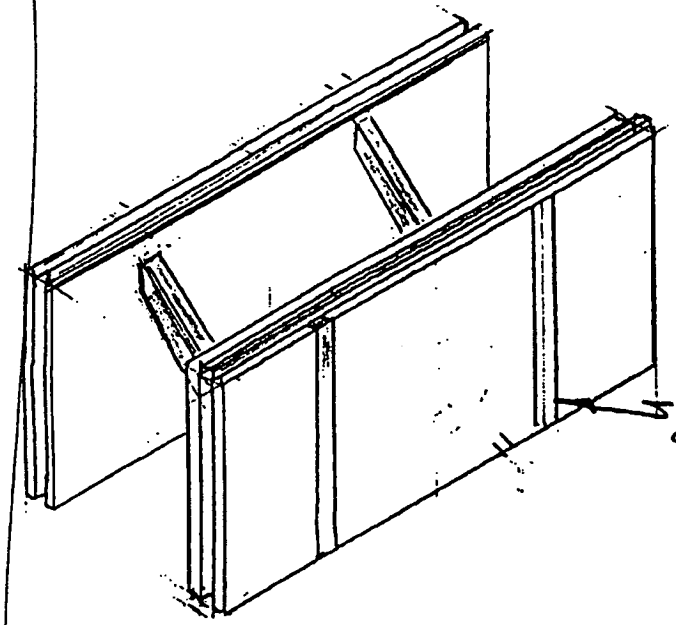


FIG 1



PRIOR ART
FIG 6



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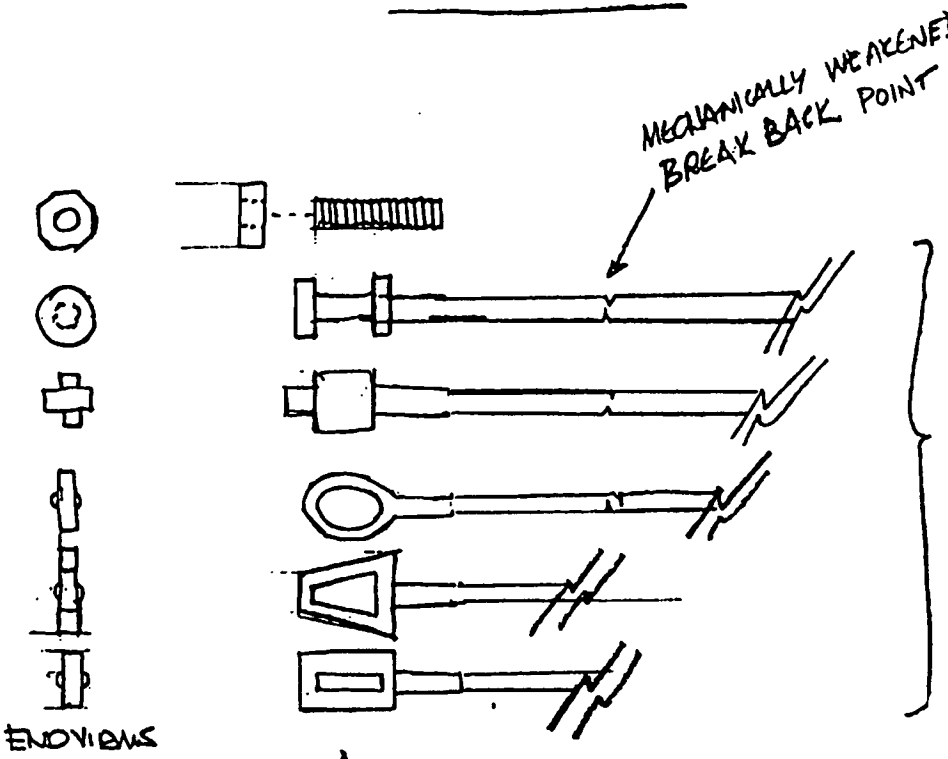
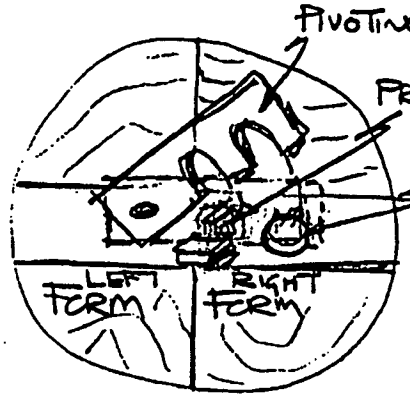


PRIOR ART FIGURE 1.

EXAMPLE FORM LATCH



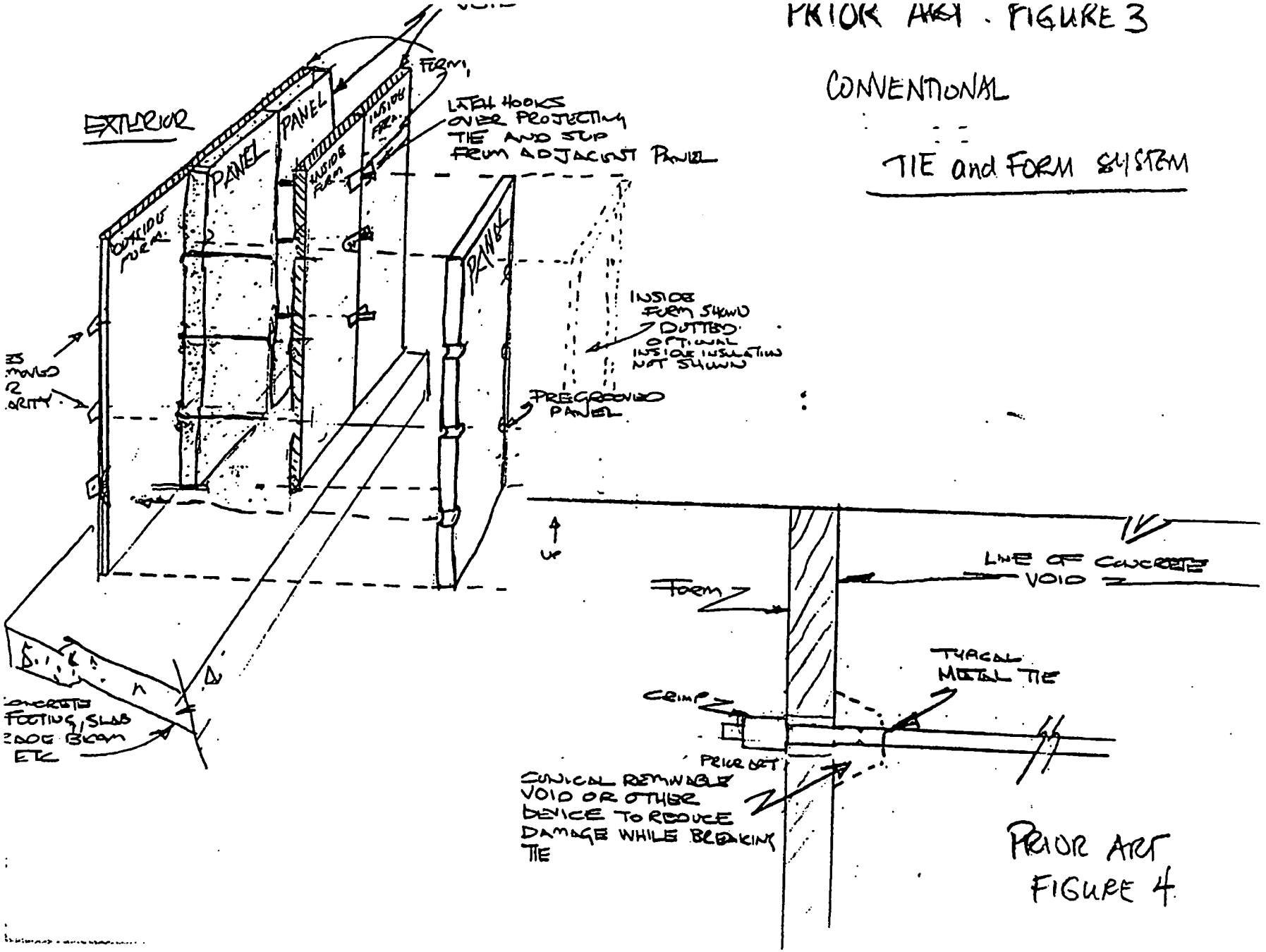
DETAIL OF TIE END CAPTURE BY LATCH TYPICAL ART

PRIOR ART FIGURE 2

PRIOR ART - FIGURE 3

CONVENTIONAL

TIE and FORM SYSTEM



PRIOR ART FIGURE 4

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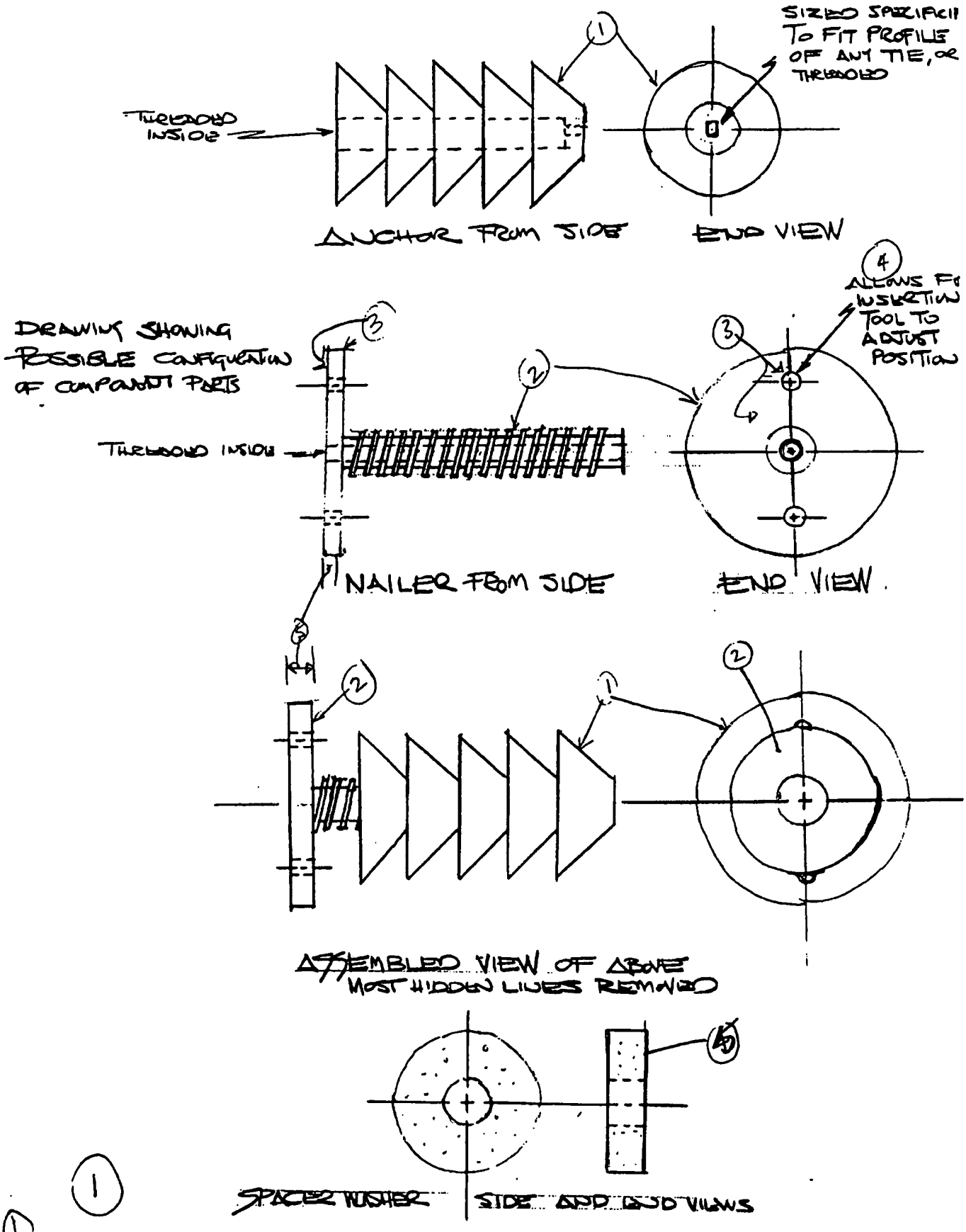
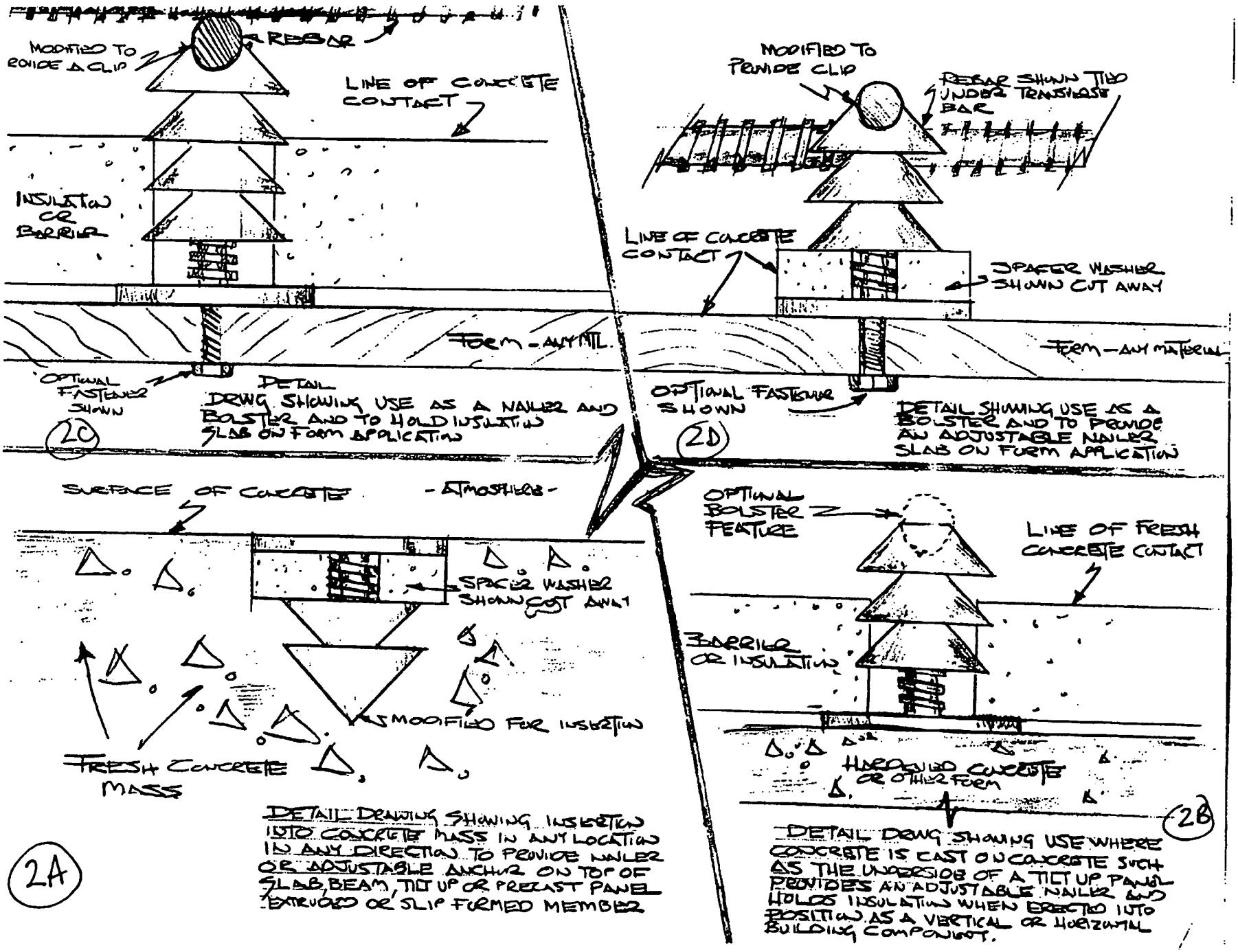

SIZED SPECIFICALLY TO FIT PROFILE OF ANY TIE, OR THRESHOLD
THRESHOLD INSIDE
ANCHOR FROM SIDE
END VIEW
DRAWING SHOWING POSSIBLE CONFIGURATION OF COMPONENT PARTS
ALLOWS FOR INSERTION TOOL TO ADJUST POSITION
THRESHOLD INSIDE
NAILER FROM SIDE
END VIEW
ASSEMBLED VIEW OF ABOVE MOST HIDDEN LINES REMOVED
SPACER WASHER
SIDE AND END VIEWS



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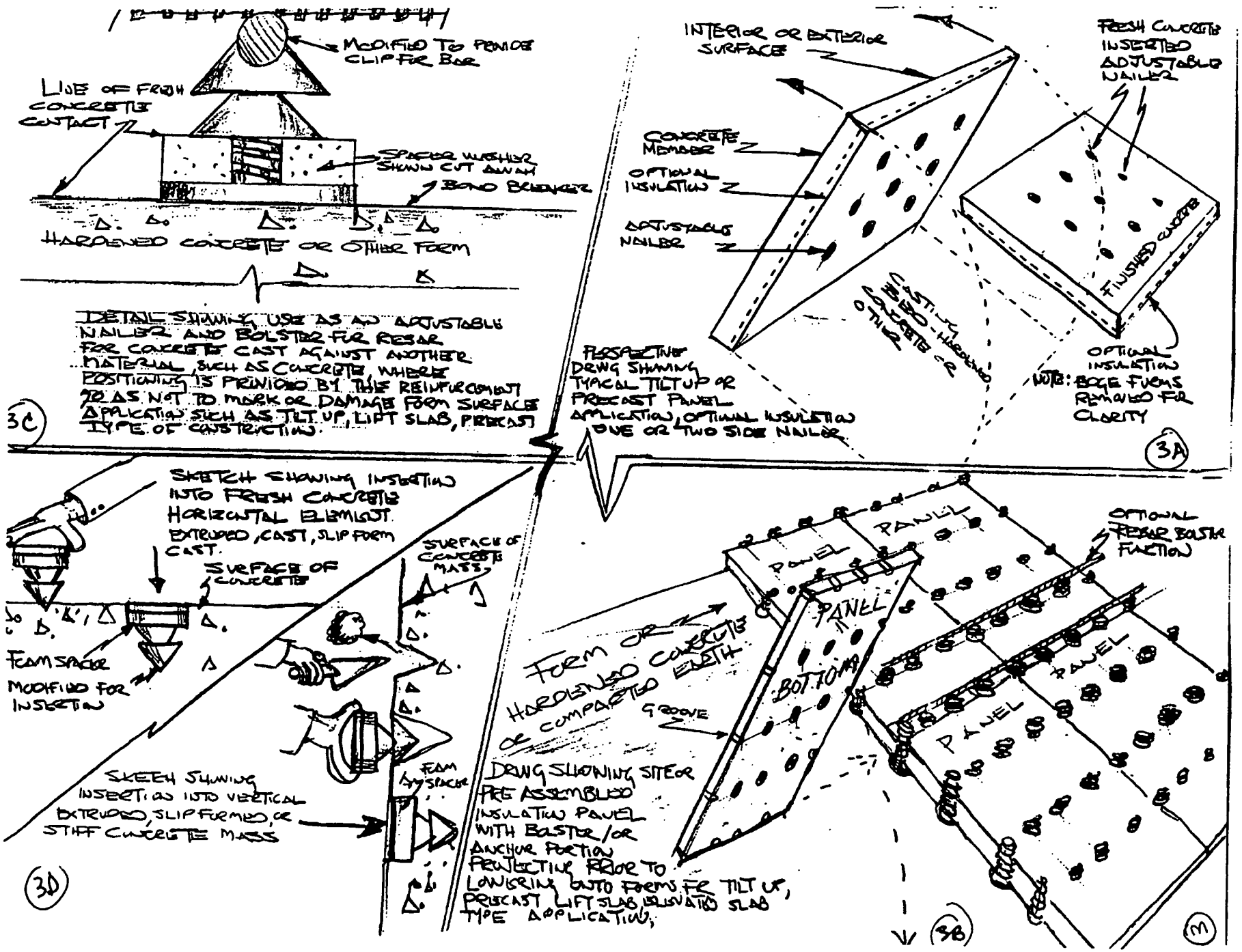
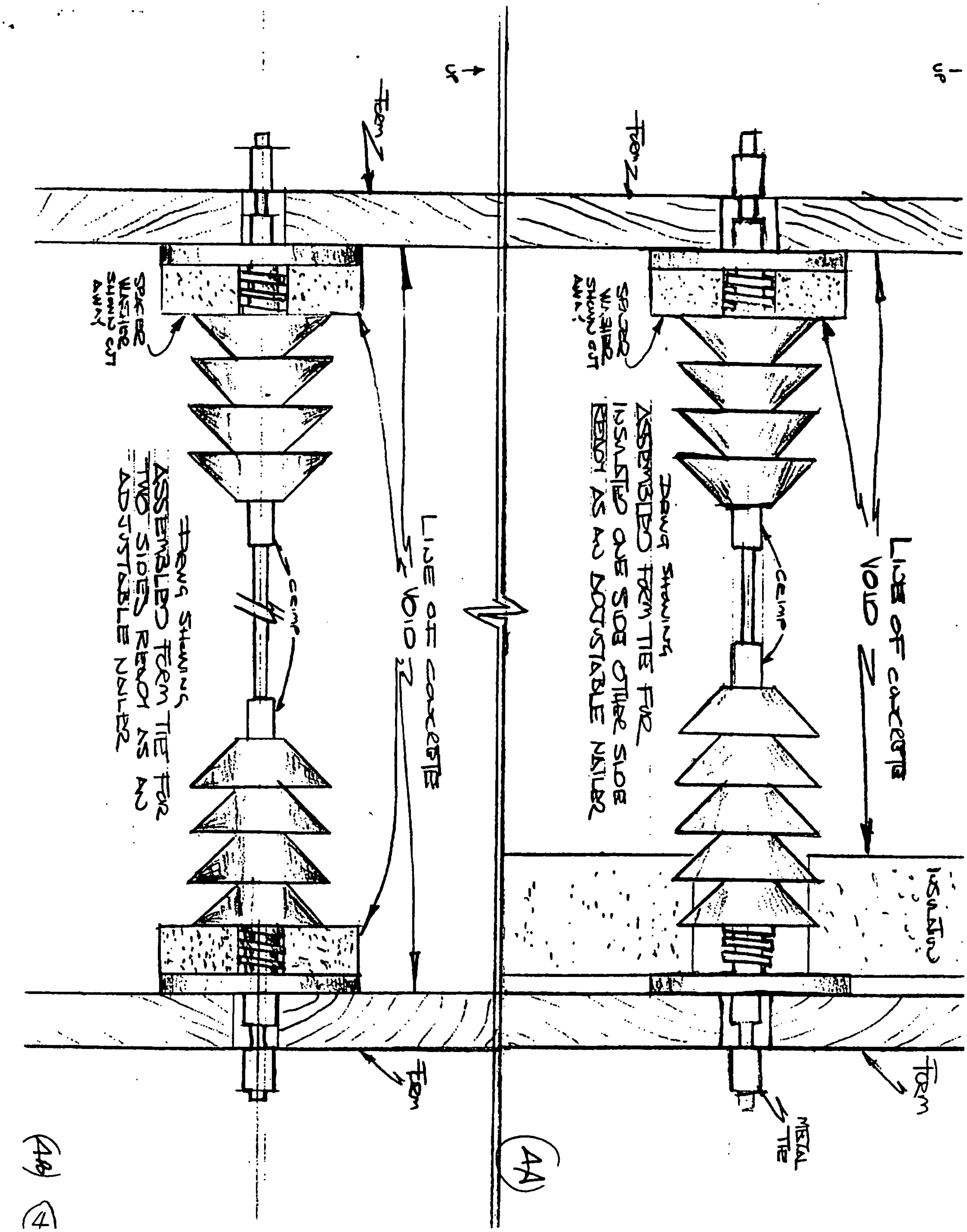
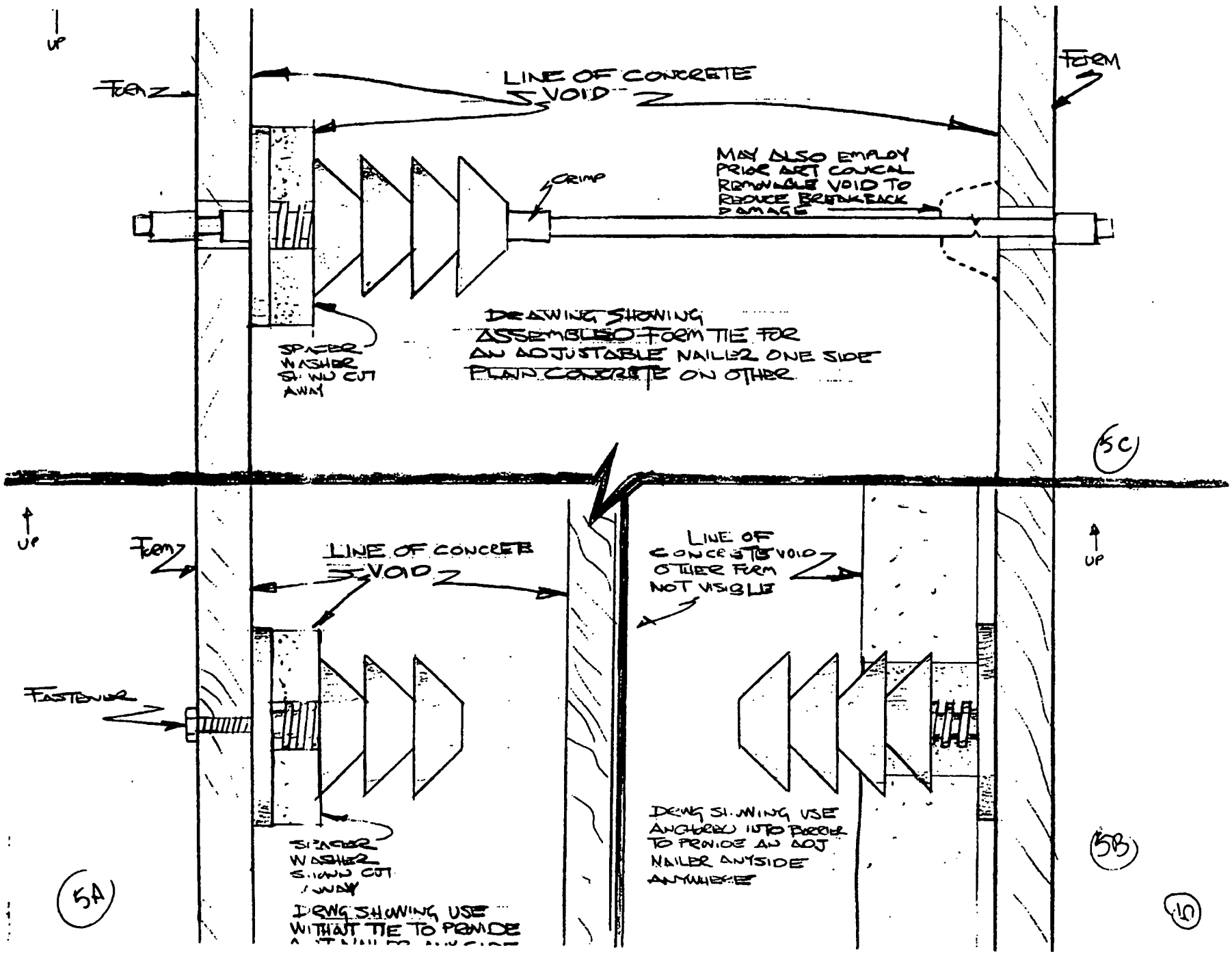



UP
UP
FORM
FORM
FORM
FORM
SPACER WASHER SHOWN CUT AWAY
SPACER WASHER SHOWN CUT AWAY
LINE OF CONCRETE VOID
LINE OF CONCRETE VOID
CRIMP
CRIMP
DRWG SHOWING ASSEMBLED FORM TIE FOR TWO SIDED READY AS AN ADJUSTABLE NAILER
DRWG SHOWING ASSEMBLED FORM TIE FOR INSULATED ONE SIDE OTHER SIDE READY AS AN ADJUSTABLE NAILER
INSULATION
METAL TIE
4B
4A
4



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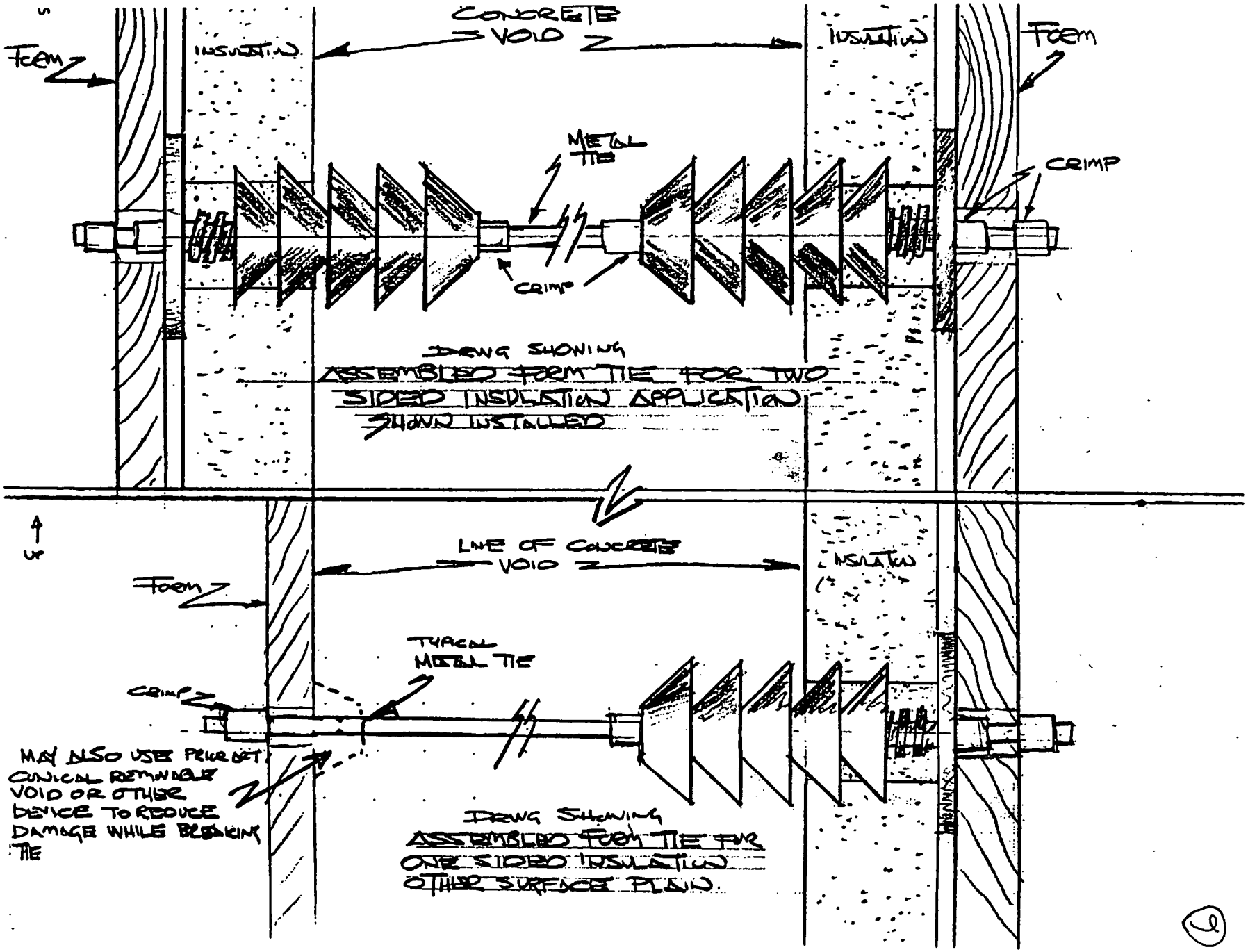

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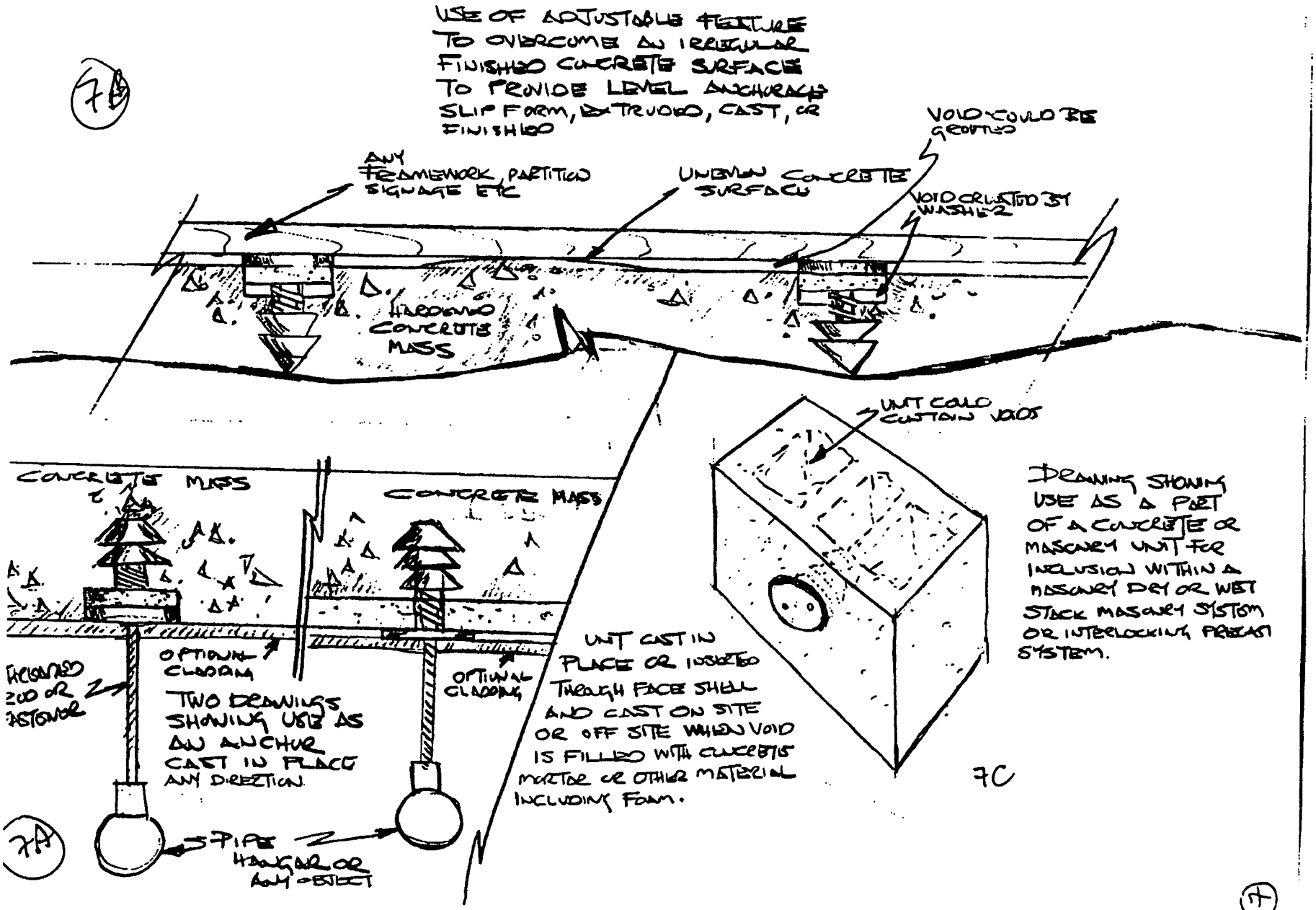

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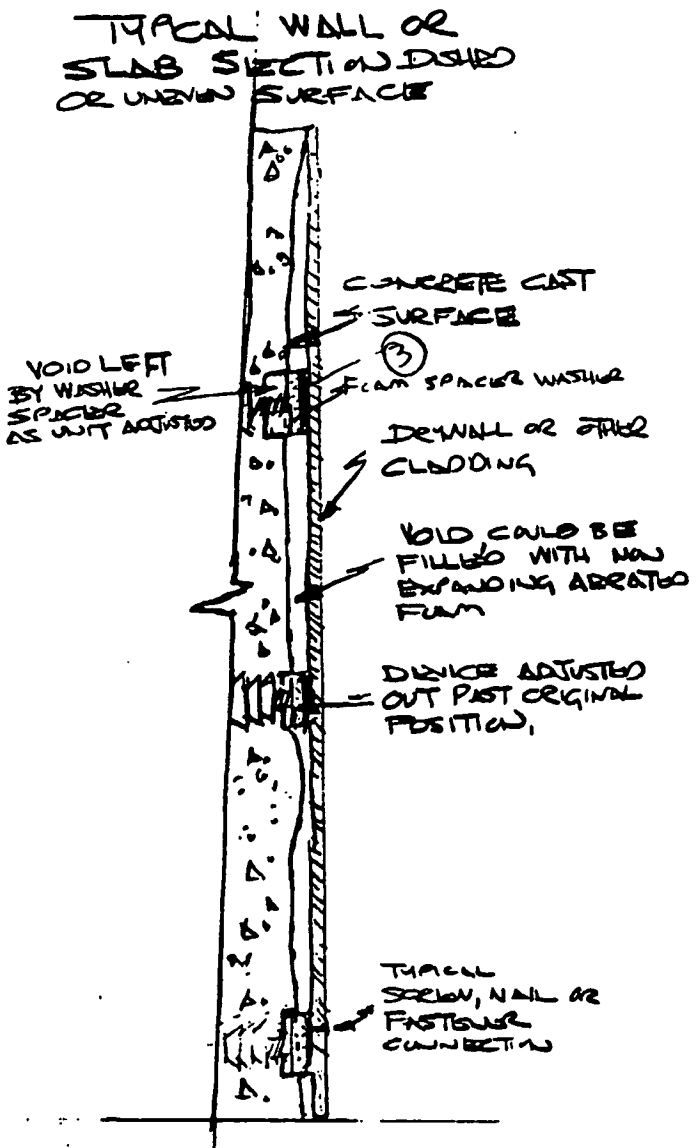
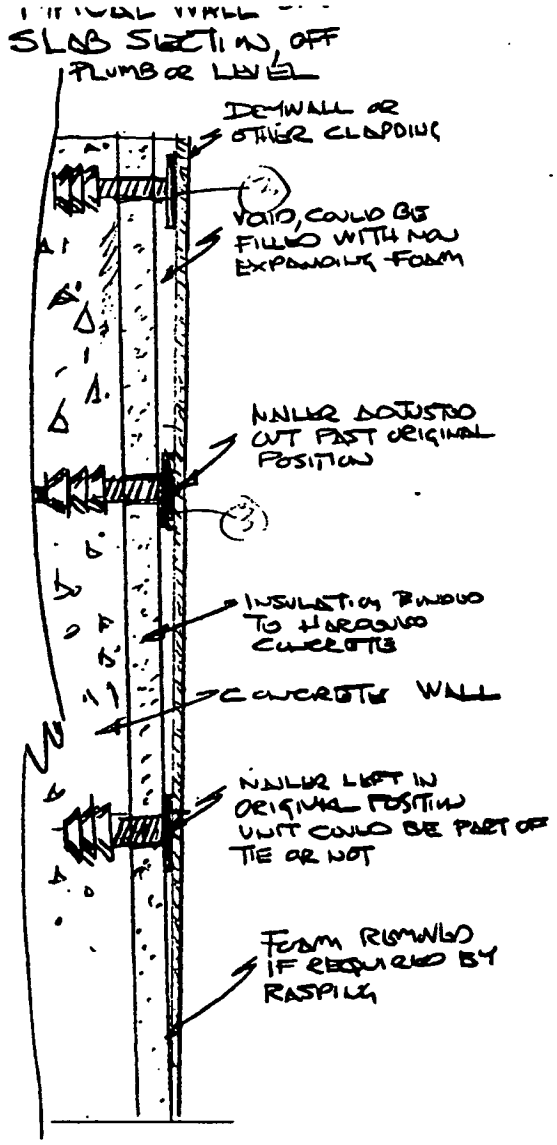


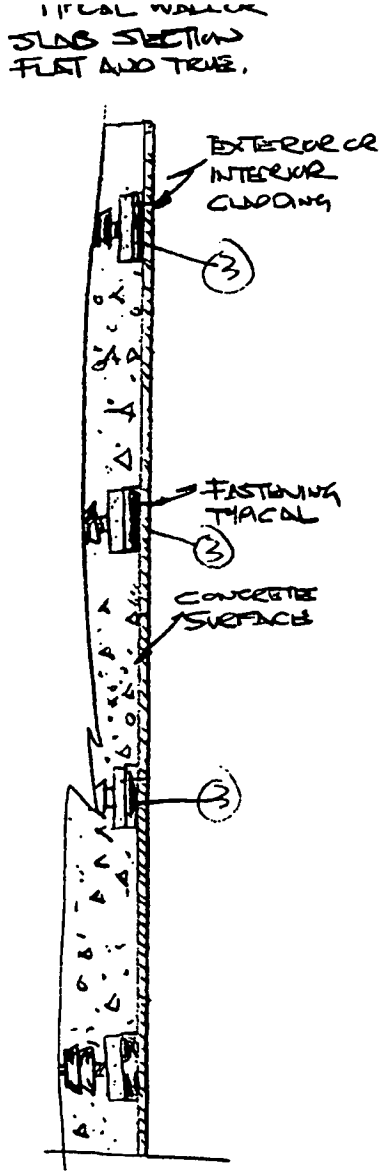
9A

USE OF ADJUSTABLE FEATURE TO OVERCOME NON PLANAR SURFACE WALL OR CEILING NON INSULATED SURFACE



USE OF ADJUSTABLE FEATURE TO OVERCOME OUT OF PLUMB OR OUT OF LEVEL INSULATED SURFACE, ANY VERTICAL OR HORIZONTAL

9B



USE OF NAILER FEATURE WHERE NO ADJUSTMENT IS NECESSARY TO ELIMINATE FURRING AS IN PRIOR ART.

9C

8

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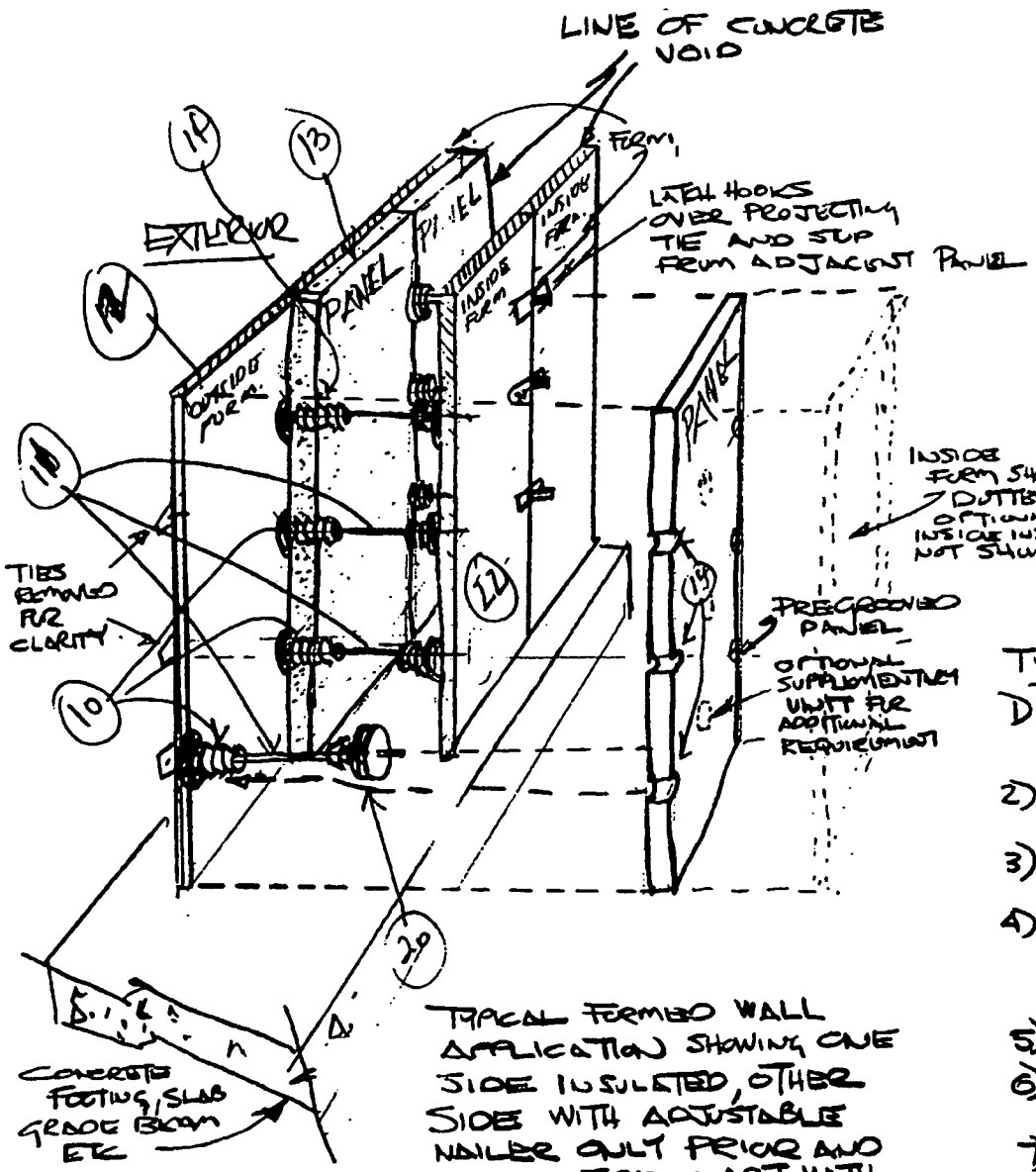
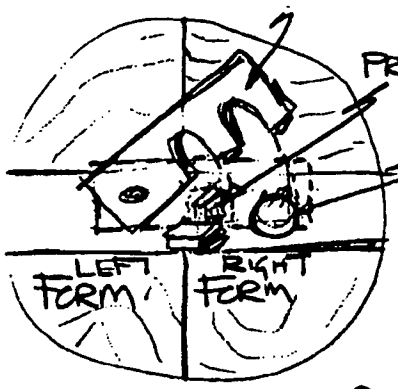


TYPICAL FORMED WALL APPLICATION SHOWING ONE SIDE INSULATED, OTHER SIDE WITH ADJUSTABLE NAILER ONLY PRIOR AND TYPICAL FORMING ART WITH CUSTOM ADAPTED FORM TIE FOR MODULAR FORMS



DETAIL OF TIE END CAPTURE BY LATCH TYPICAL ART

TYPICAL SEQUENCE

1) OUTSIDE FORM LATCHED TOGETHER, CAPTURING TIE, TIE LEFT PROJECTING
2) PANEL TILTED PAST TIE AND CAPTURED BY ANCHOR AT GROOVES
3) REBAR INSTALLED SINGLE OR DOUBLE LAYER.
4) INSIDE FORM LATCHED TOGETHER CAPTURING CRIMPED TIE END PORTION.
5) CONCRETE POURED, SET, HARDENED
6) LATCH FLIPPED AND FORMS REMOVED
7) TIE TWISTED WITH TOOL TO BREAKBACK WITHIN DEVICE.
8) BOTH SURFACES READY FOR CLADDING / FINISHES

9
6

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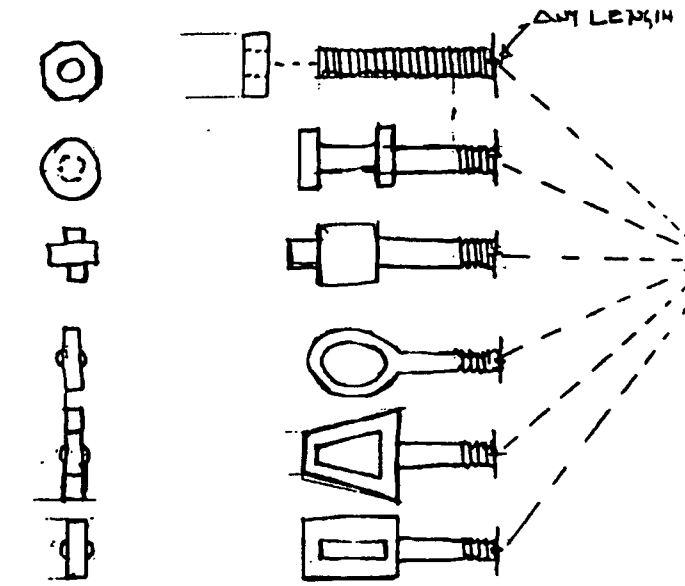
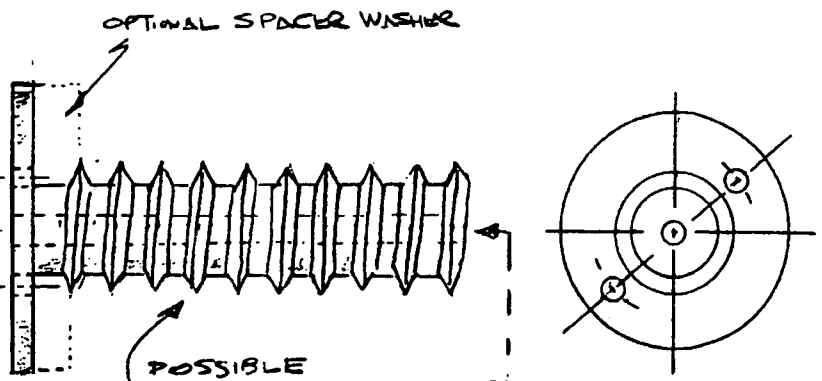
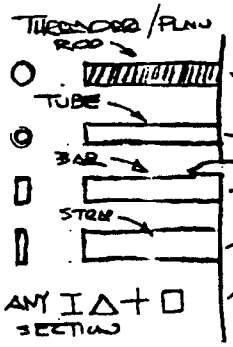


END VIEWS

SIDE VIEW OF SOME POSSIBLE ADAPTING INSERTS FOR ONE PIECE OR TWO PIECE CONFIGURATION OPTIONAL THREAD SHOWN





END VIEW SIDE VIEW

POSSIBLE ADAPTING TIE CENTRE SECTIONS FOR ONE OR TWO PIECE CONFIGURATION

NOTE

ONE PIECE CONFIGURATION USES CAST CONCRETE AS A THREAD SEAT AS WELL AS ANCHOR SEAT. ADJUSTMENT IS MADE OUT POST INITIAL POSITION ONLY.

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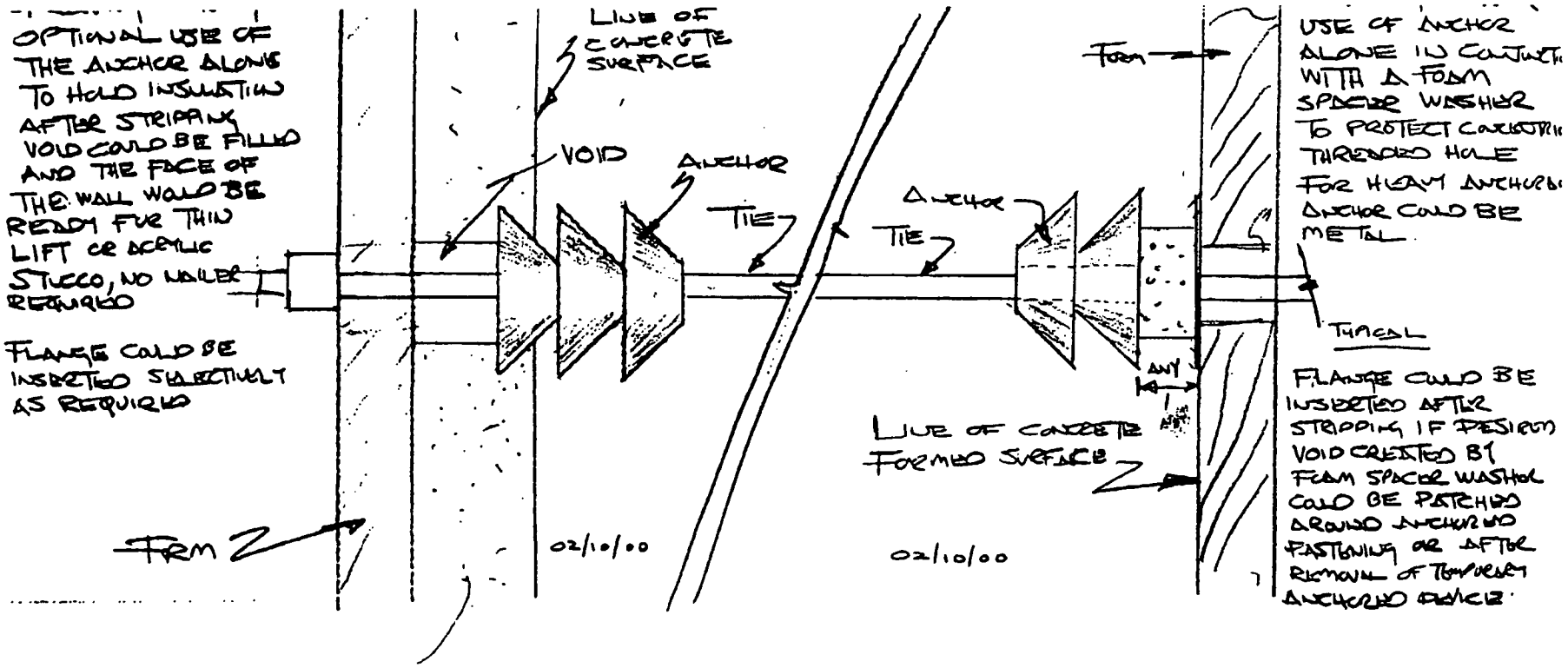
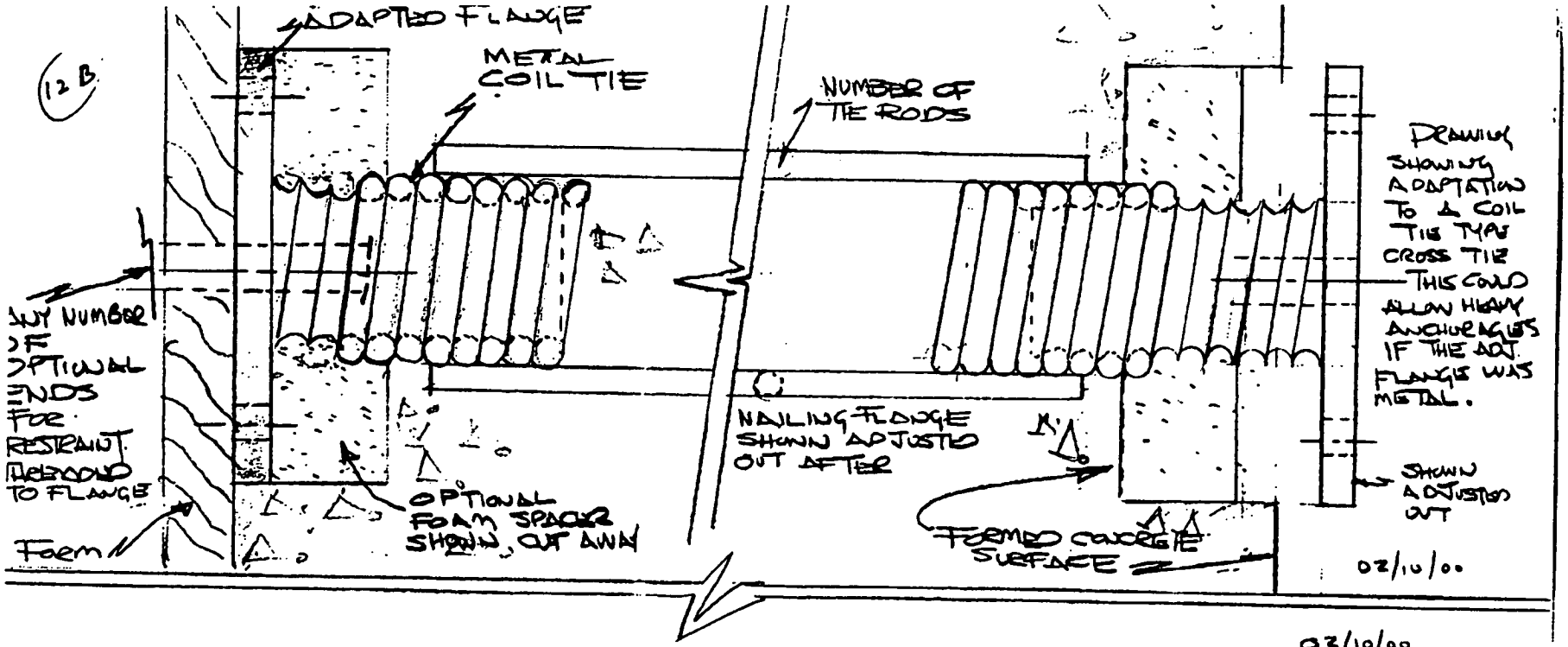


11

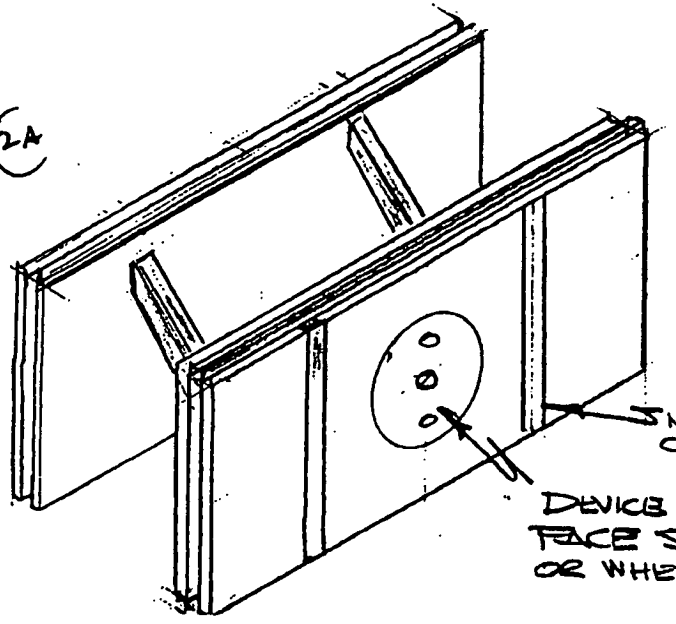
B2

12B



02/10/00

12A



TYPICAL "ICF" BLOCK - PREMOLD OR ASSEMBLED ON SITE

NAILING FLANGE/ CROSS TIE

DEVICE INSERTED IN FACE SHELL, ON SITE OR WHEN MANUFACTURED

DRAWING SHOWING THE USE WITHIN AN EXISTING "ICF" OR INSULATED CONCRETE FORM SYSTEM, COULD BE USED ONE SIDE TWO SIDES, OR COULD FORM PART OF, OR BE THE CROSS TIE COMPONENT OF AN ICF SYSTEM. IN THIS SKETCH, WOULD PROVIDE AN ADJUSTABLE NAILER OR ANCHOR

B1

12

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